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**PHILOSOPHICAL
TRANSACTIONS**

OF THE

ROYAL SOCIETY

OF

LONDON.

FOR THE YEAR MDCCCLI.

PART I.

LONDON:

PRINTED BY RICHARD TAYLOR, RED LION COURT, FLEET STREET.

MDCCCLI.

ADVERTISEMENT.

THE Committee appointed by the *Royal Society* to direct the publication of the *Philosophical Transactions*, take this opportunity to acquaint the Public, that it fully appears, as well from the Council-books and Journals of the Society, as from repeated declarations which have been made in several former *Transactions*, that the printing of them was always, from time to time, the single act of the respective Secretaries till the Forty-seventh Volume; the Society, as a Body, never interesting themselves any further in their publication, than by occasionally recommending the revival of them to some of their Secretaries, when, from the particular circumstances of their affairs, the *Transactions* had happened for any length of time to be intermitted. And this seems principally to have been done with a view to satisfy the Public, that their usual meetings were then continued, for the improvement of knowledge, and benefit of mankind, the great ends of their first institution by the Royal Charters, and which they have ever since steadily pursued.

But the Society being of late years greatly enlarged, and their communications more numerous, it was thought advisable that a Committee of their members should be appointed, to reconsider the papers read before them, and select out of them such as they should judge most proper for publication in the future *Transactions*; which was accordingly done upon the 26th of March 1752. And the grounds of their choice are, and will continue to be, the importance and singularity of the subjects, or the advantageous manner of treating them; without pretending to answer for the certainty of the facts, or propriety of the reasonings, contained in the several papers so published, which must still rest on the credit or judgement of their respective authors.

It is likewise necessary on this occasion to remark, that it is an established rule of the Society, to which they will always adhere, never to give their opinion, as a Body,

upon any subject, either of Nature or Art, that comes before them. And therefore the thanks, which are frequently proposed from the Chair, to be given to the authors of such papers as are read at their accustomed meetings, or to the persons through whose hands they received them, are to be considered in no other light than as a matter of civility, in return for the respect shown to the Society by those communications. The like also is to be said with regard to the several projects, inventions, and curiosities of various kinds, which are often exhibited to the Society; the authors whereof, or those who exhibit them, frequently take the liberty to report and even to certify in the public newspapers, that they have met with the highest applause and approbation. And therefore it is hoped that no regard will hereafter be paid to such reports and public notices; which in some instances have been too lightly credited, to the dishonour of the Society.

The Meteorological Journal hitherto kept by the Assistant Secretary at the Apartments of the Royal Society, by order of the President and Council, and published in the Philosophical Transactions, has been discontinued. The Government, on the recommendation of the President and Council, has established at the Royal Observatory at Greenwich, under the superintendence of the Astronomer Royal, a Magnetic and Meteorological Observatory, where observations are made on an extended scale, which are regularly published. These, which correspond with the grand scheme of observations now carrying out in different parts of the globe, supersede the necessity of a continuance of the observations made at the Apartments of the Royal Society, which could not be rendered so perfect as was desirable, on account of the imperfections of the locality and the multiplied duties of the observer.

A List of Public Institutions and Individuals, entitled to receive a copy of the Philosophical Transactions of each year, on making application for the same directly or through their respective agents, within five years of the date of publication.

Observatories.

Armagh.
Cape of Good Hope.
Dublin.
Edinburgh.
Greenwich.
Madras.

Institutions.

BarbadoesLibrary and Museum.
CalcuttaAsiatic Society.
CambridgePhilosophical Society.
Dublin.....Royal Dublin Society.
 Royal Irish Academy.
EdinburghRoyal Society.
LondonAdmiralty Library.
 Chemical Society.
 Entomological Society.
 Geological Society.
 Geological Survey of Great Britain.
 Horticultural Society.
 Institute of British Architects.
 Institution of Civil Engineers.
 Linnean Society.
 London Institution.
 Medical and Chirurgical Society.
 Queen's Library.
 Royal Asiatic Society.
 Royal Astronomical Society.
 Royal College of Physicians.
 Royal Geographical Society.
 Royal Institution of Great Britain.
 Royal Society of Literature.
 Society of Antiquaries.
 Society for the Encouragement of Arts.
 United Service Museum.
 Zoological Society.
ManchesterLiterary and Philosophical Society.
Oxford.....Ashmolean Society.
 Radcliffe Library.
SwanseaRoyal Institution.
WoolwichRoyal Artillery Library.

Belgium.

BrusselsRoyal Academy of Sciences.

Denmark.

AltonaRoyal Observatory.
Copenhagen.....Royal Society of Sciences.

France.

ParisAcademy of Sciences.
 Dépôt de la Marine.
 École des Mines.

ParisEntomological Society.
 Geographical Society.
 Geological Society.
 Jardin des Plantes.
ToulouseAcademy of Sciences.

Germany.

BonnCæsarean Acad. of Naturalists.
GöttingenUniversity.
MannheimObservatory.
MunichRoyal Academy of Sciences.

Italy.

NaplesInstitute of Sciences.
MilanInstitute of Sciences, Letters and Arts.
ModenaItalian Society of Sciences.
TurinRoyal Academy of Sciences.

Netherlands.

AmsterdamRoyal Institute.
RotterdamBatavian Society of Experimental Philosophy.

Prussia.

BerlinRoyal Academy of Sciences.
 Society of Experimental Philosophy.

Portugal.

LisbonRoyal Academy of Sciences.

Russia.

PulkowaObservatory.
St. PetersburgImperial Academy of Sciences.

Spain.

CadizObservatory.

Sweden and Norway.

DrontheimRoyal Society of Sciences.
StockholmRoyal Academy of Sciences.

Switzerland.

GenevaSociété de Phys. et d'Hist. Naturelle.

United States.

BostonAmerican Academy of Sciences.
CambridgeHarvard University.
PhiladelphiaAmerican Philosophical Society.
Washington.....Smithsonian Institution.
 Observatory.

The *fifty* Foreign Members of the Royal Society.

A List of Public Institutions and Individuals, entitled to receive a copy of the Astronomical Observations (including Magnetism and Meteorology) made at the Royal Observatory at Greenwich, on making application for the same directly or through their respective agents, within two years of the date of publication.

Observatories.

Altona.
 Armagh.
 Berlin.
 Breslau.
 Brussels.
 Cadiz.
 Cambridge.
 Cape of Good Hope.
 Coimbra.
 Copenhagen.
 Dorpat.
 Dublin.
 Edinburgh.
 Helsingfors.
 Königsberg.
 Madras.
 Mannheim.
 Marseilles.
 Milan.
 Munich.
 Oxford.
 Palermo.
 Paris.
 Seeberg.
 Trevandrum.
 Tübingen.
 Turin.
 Vienna.
 Wilna.

Institutions.

Aberdeen.....University.
 BerlinAcademy.
 BolognaAcademy.
 BostonAmerican Academy of Sciences.
 Brunswick, U.S. ...Bowdoin College.
 CambridgeTrinity College Library.
 Cambridge, U.S....Harvard University.
 DublinUniversity.
 EdinburghUniversity.
 Royal Society.
 GlasgowUniversity.
 GöttingenUniversity.
 LeydenUniversity.
 LondonBoard of Ordnance.
 Queen's Library.
 Royal Institution.
 Royal Society.
 Oxford.....Savilian Library.
 ParisAcademy of Sciences.
 Board of Longitude.
 Dépôt de la Marine.
 PhiladelphiaAmerican Philosophical Society.
 St. AndrewsUniversity.
 St. Petersburg ...Imperial Academy.
 StockholmRoyal Academy of Sciences.
 UpsalRoyal Society.
 Waterville (U.S.)...College.

Individuals.

Christie, S. H., Esq. Woolwich.
 Lubbock, Sir John William, Bart. ... London.
 Lowndes Professor of Astronomy ... Cambridge.
 Plumian Professor of Astronomy
 President of the Royal Society..... London.
 Smyth, Captain W. H., R.N. Aylesbury.
 South, Sir James Kensington.

List of Observatories, Institutions and Individuals, entitled to receive a Copy of the Magnetical and Meteorological Observations made at the Royal Observatory, Green- wich.

Observatories.

Bombay	Capt. Monthiou.
Barnaoul	M. Prang, 1st.
Cairo	M. Lambert.
Cambridge, United States	Prof. Lovering.
Catherineburgh	M. Rochkoff.
Christiania	M. Hansteen.
Cincinnati	Dr. Locke.
Gotha	
Hammerfest	
Heidelberg	M. Tiedemann.
Hobarton	Commander Kay, R.N.
Kasan	M. Simonoff.
Kew	F. Ronalds, Esq.
Kremsmünster	Prof. Koller.
Leipsic	
Marburg	Prof. Gerling.
Nertchinsk	M. Prang, 2nd.
Nikolaieff	Dr. Knorre.
Pekin	M. Gachkévitche.
Prague	M. Kreil.
Pulkowa	M. Struve.
St. Petersburg	M. Kupffer.
Sitka	Messrs. Homann and Ivanoff.
Stockholm	Prof. Selander.
Teflis	M. Philadelphine.
Toronto	Captain Lefroy, R.A.
Upsal	Prof. Svanberg.
Warsaw	Col. G. Du Plat (British Consul).
Washington	Lt. Maury, U.S. Navy.

Institutions.

Bombay	Geographical Society.
Bonn	University.
Bowditch Library	United States.
Cambridge	Library, Philosophical Society.
Cherkow	University.
Kiew	University.
London	House of Lords, Library. House of Commons, Li- brary. King's College.

London	Royal Institution.
.	Royal Society.
.	University.
Moscow	University.
Royal Cornwall Polytechnic Society	
St. Bernard	Convent.
St. Petersburg	Geographical Society.
Washington	Smithsonian Institution.
Woolwich	Office of Mag. and Met. Publication.

Individuals.

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Colebrooke, Sir W.	Barbadoes.
Demidoff, Prince Anatole de	Florence.
Dove, Prof.	Berlin.
Elliot, Capt. C. M.	
Erman, Dr. Adolph	Berlin.
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Gilliss, Lt. J. M., U.S. Navy	Washington.
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Humboldt, Baron von	Berlin.
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Kupffer, A. T.	St. Petersburg.
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Lütke, Vice-Admiral	St. Petersburg.
Melvill, J. C., Esq.	East India House.
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Redfield, W. C., Esq.	New York.
Reid, Lieut.-Col., R.E.	London.
Riddell, Capt., R.A.	Woolwich.
Roget, P. M., M.D.	London.
Sabine, Lieut.-Col., R.A.	Woolwich.
Senftenberg, Baron von	Prague.
Wartmann, Prof. Elie	Geneva.
Wrangell, Vice-Admiral	St. Petersburg.
Younghusband, Capt., R.A.	Woolwich.

ROYAL MEDALS.

HER MAJESTY QUEEN VICTORIA, in restoring the Foundation of the Royal Medals, has been graciously pleased to approve the following regulations for the award of them :

That the Royal Medals be given for such papers only as have been presented to the Royal Society, and inserted in their Transactions.

That the triennial Cycle of subjects be the same as that hitherto in operation : viz.

1. Astronomy ; Physiology, including the Natural History of Organized Beings.
2. Physics ; Geology or Mineralogy.
3. Mathematics ; Chemistry.

That, in case no paper, coming within these stipulations, should be considered deserving of the Royal Medal, in any given year, the Council have the power of awarding such Medal to the author of any other paper on either of the several subjects forming the Cycle, that may have been presented to the Society and inserted in their Transactions ; preference being given to the subjects of the year immediately preceding : the award being, in such case, subject to the approbation of Her Majesty.

The Council propose to give one of the Royal Medals in the year 1851 for the most important paper in Astronomy, communicated to the Royal Society after the termination of the Session in June 1847, and prior to the termination of the Session in June 1850, and printed in the Philosophical Transactions.

The Council propose also to give one of the Royal Medals in the year 1851 for the most important paper in Physiology, including the Natural History of Organized

Beings, communicated to the Royal Society after the termination of the Session in June 1847, and prior to the termination of the Session in June 1850, and printed in the Philosophical Transactions.

The Council propose to give one of the Royal Medals in the year 1852 for the most important paper in Physics, communicated to the Royal Society after the termination of the Session in June 1848, and prior to the termination of the Session in June 1851, and printed in the Philosophical Transactions.

The Council propose also to give one of the Royal Medals in the year 1852 for the most important paper in Geology or Mineralogy, communicated to the Royal Society after the termination of the Session in June 1848, and prior to the termination of the Session in June 1851, and printed in the Philosophical Transactions.

C O N T E N T S.

- I. THE BAKERIAN LECTURE.—*Experimental Researches in Electricity.—Twenty-fourth Series.* By MICHAEL FARADAY, Esq., D.C.L., F.R.S., Fullerian Prof. Chem. Royal Institution, Foreign Associate of the Acad. Sciences, Paris, Ord. Boruss. Pour le Mérite, Eq., Memb. Royal and Imp. Acadd. of Sciences, Petersburg, Florence, Copenhagen, Berlin, Göttingen, Modena, Stockholm, Munich, Bruxelles, Vienna, Bologna, &c. &c. page 1
- II. *Experimental Researches in Electricity.—Twenty-fifth Series.* By MICHAEL FARADAY, Esq., D.C.L., F.R.S., Fullerian Prof. Chem. Royal Institution, Foreign Associate of the Acad. Sciences, Paris, Ord. Boruss. Pour le Mérite, Eq., Memb. Royal and Imp. Acadd. of Sciences, Petersburg, Florence, Copenhagen, Berlin, Göttingen, Modena, Stockholm, Munich, Bruxelles, Vienna, Bologna, &c. &c. 7
- III. *Experimental Researches in Electricity.—Twenty-sixth Series.* By MICHAEL FARADAY, Esq., D.C.L., F.R.S., Fullerian Prof. Chem. Royal Institution, Foreign Associate of the Acad. Sciences, Paris, Ord. Boruss. Pour le Mérite, Eq., Memb. Royal and Imp. Acadd. of Sciences, Petersburg, Florence, Copenhagen, Berlin, Göttingen, Modena, Stockholm, Munich, Bruxelles, Vienna, Bologna, &c. &c. 29
- IV. *Experimental Researches in Electricity.—Twenty-seventh Series.* By MICHAEL FARADAY, Esq., D.C.L., F.R.S., Fullerian Prof. Chem. Royal Institution, Foreign Associate of the Acad. Sciences, Paris, Ord. Boruss. Pour le Mérite, Eq., Memb. Royal and Imp. Acadd. of Sciences, Petersburg, Florence, Copenhagen, Berlin, Göttingen, Modena, Stockholm, Munich, Bruxelles, Vienna, Bologna, &c. &c. 85
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PHILOSOPHICAL
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PART II.

LONDON:

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MDCCCLI.

ADJUDICATION of the MEDALS of the ROYAL SOCIETY for the year 1851 by
the PRESIDENT and COUNCIL.

The COPLEY MEDAL to Professor OWEN, for his important discoveries in Comparative Anatomy and Palæontology, contained in the Philosophical Transactions and numerous other works.

The ROYAL MEDAL in the department of Astronomy, to The EARL OF ROSSE, for his "Observations on the Nebulæ," published in the Philosophical Transactions for the year 1850.

The ROYAL MEDAL in the department of Physiology, to GEORGE NEWPORT, Esq., for his paper "On the Impregnation of the Ovum in the Amphibia" (First Series), published in the Philosophical Transactions for the year 1851.

C O N T E N T S.

- XIII. *On the Results of Periodical Observations of the Positions and Distances of Nineteen of the Stars in Sir JOHN HERSCHEL'S Lists of Stars, favourably situated for the investigation of Parallax, contained in Part III. of the Philosophical Transactions for 1826, and Part I. 1827.* By Lord WROTTESLEY, F.R.S. &c. page 333
- XIV. *Researches into the Molecular Constitution of the Organic Bases.* By Dr. A. W. HOFMANN, F.C.S., Professor of the Royal College of Chemistry of London. (Second Memoir.) Communicated by Sir JAMES CLARK, Bart., F.R.S. . 357
- XV. *Contributions to Animal Chemistry.*—Paper V. *On the Oxidation of Ammonia in the Human Body, with some Remarks on Nitrification.* By HENRY BENCE JONES, M.D., M.A. Cantab., F.R.S., Physician to St. George's Hospital. 399
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- XXVI. *Researches into the Structure of the Spinal Chord.* By J. LOCKHART CLARKE, Esq. Communicated by SAMUEL SOLLY, Esq., F.R.S. 607
- XXVII. *On the Meteorology of the Lake District of Cumberland and Westmoreland, including the Results of Experiments on the Fall of Rain at various heights, up to 3166 feet above the sea-level.—Fourth paper, for the year 1850.* By JOHN FLETCHER MILLER, F.R.S., F.R.A.S., Assoc. Inst. C.E. &c. 623
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- XXX. *Report of further Observations upon the Tidal Streams of the North Sea and*

English Channel, with Remarks upon the Laws by which those Streams appear to be governed. By Captain F. W. BEECHEY, R.N., F.R.S. Communicated to Sir FRANCIS BEAUFORT, K.C.B., Hydrographer, and presented to the Royal Society by G. B. AIRY, Esq., F.R.S., and Astronomer Royal, &c. . . page 703

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APPENDIX.

Presents [1]

ERRATA.

Page 297, line 9 from the bottom, *for* garnet-octohedrons *read* garnet-dodecahedrons.

— 398, line 13 from the bottom, *for* $(H_4 N)_2$ *read* $(H_4 N)$.

— 500, line 16, *for* J *read* $\frac{dJ}{dr}$.

In Art. 6, page 519, change β to β_1 wherever it is a factor of quantities containing Y_2 or other terms in the development of y .

Page 522, line 13 from bottom, *for* c_1 *read* C_1 .

— 531, line 14 from bottom, *for* (23.) *read* (33.).

— 539, line 2 from bottom, *for* j_2 *read* j .

— 703, *for* HEWITT *read* HEWETT; *for* BEAUTEMS BEAUPRES *read* BEAUTEMS BEAUPRÉ; *for* Engineers *read* Ingenieurs; *for* Française *read* Français.

— 709 and 712, *for* Lemon *read* Leman.